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ON THE NATURE AND ORIGIN OF HISINGERITE FROM PARRY SOUND, ONTARIO

G. M. SCHWARTZ, *University of Minnesota*

The writer has recently noted the occurrence of hisingerite in specimens in the University of Minnesota collection of copper ores from Parry Sound, Ontario.[1] The mineral is abundant in these ores and as it is comparatively uncommon, and this occurrence seems unlike those formerly described, the material was studied in some detail.

Hisingerite is a hydrous silicate of iron and magnesia with small amounts of other constituents, but apparently of variable or indefinite composition. Larsen[2] lists it as amorphous or cryptocrystalline with the index of refraction varying from $1.51\pm$ to $1.59\pm$, and does not assign a definite formula. Simpson[3] assigned the formula $Fe_2O_3.2SiO_2.2H_2O$ plus adsorbed water as a result of an analysis of material from a gold mine in Australia. Hawkins and Shannon[4] have described a new mineral, canbyite, which is believed to be the crystalline equivalent of hisingerite, and they assign the formula $H_4Fe'''_2Si_2O_9.2H_2O$ to it.

In the material from Parry Sound the index varies from about 1.50 to 1.56, and this seems to be true of both the isotropic and crystalline varieties. In thin section and powder it has a bright orange or brown color, especially at the edges. Part of the material is anisotropic and gives a biaxial interference figure. The two thin sections available, which show the mineral, indicate a predominance of anisotropic material, but a study of the powder from various specimens indicates that the amorphous material is more abundant. The two types are intimately mixed and can not be

[1] Schwartz, G. M., Primary relationships and unusual chalcopyrite at Parry Sound, Ontario: *Econ. Geol.*, **19**, 206-209, (1924).

[2] Larsen, E. S., The microscopic determination of the non-opaque minerals: *U. S. Geol. Survey, Bull.* **679**, (1921).

[3] Simpson, E. S., *Proc. Roy. Soc. West Australia*, **5**, 95-97, (1920).

[4] Hawkins, A. C., and Shannon, E. V., Canbyite, a new mineral: *Am. Min.*, **9**, 1-4, (1924).

distinguished in plain light. (Fig. 1.) In thin section the mineral shows numerous irregular fractures. The streak is yellow and

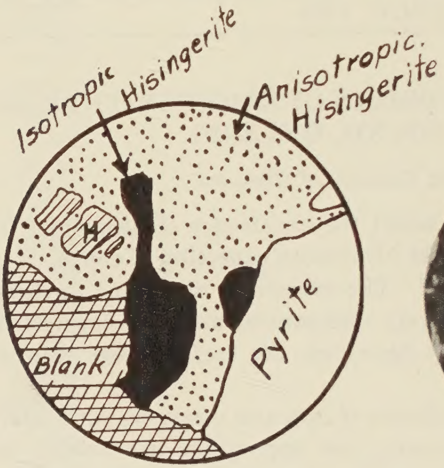


Fig. 1. (Left) Sketch from a thin section showing the relations of isotropic and anisotropic hisingerite in the same field. The two cannot be distinguished in plain light. Hypersthene (H). Wilcox mine. Mag. × 30.

Fig. 2. (Right) Micrograph of a thin section showing remnants of hypersthene (Hy) in hisingerite (dark). Quartz grains (Q). Pyrite-chalcopyrite ore from the Wilcox mine. Mag. × 50.

similar to that of limonite. An analysis by Mr. R. J. Leonard gave the following results.

Analysis of Hisingerite

SiO_2	35.57
TiO_2	.12
Fe_2O_3	39.20
FeO	4.80
Al_2O_3	.38
CaO	.85
MgO	1.60
H_2O above 110° C	11.60
H_2O below 110° C	6.00
Total	100.12

Sp. G. 2.50

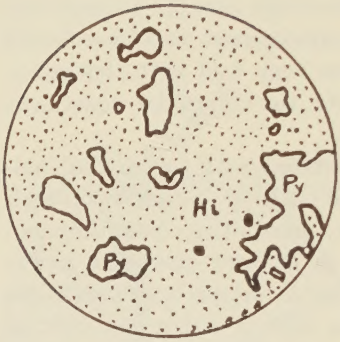
The material analyzed was examined in powdered form and proved to be about three fourths amorphous and one fourth crystalline. The analysis corresponds very well with that given by Hawkins and Shannon for canbyite, the crystalline equivalent of hisingerite.

The mineral occurs intimately associated with pyrite and chalcopyrite ore from the Wilcox mine. Other metallic minerals noted in these ores are: magnetite, pyrrhotite, cubanite, and sphalerite, but hisingerite is found in contact only with pyrite and chalcopyrite. The ores are found as masses and disseminations in pre-Cambrian garnet biotite schists which also contain plagioclase, hypersthene, hornblende, apatite, quartz, etc. Commonly the hisingerite occurs as a matrix to coarse irregular grains or crystals of pyrite, with masses of chalcopyrite more or less abundant, and in some places almost supplanting the hisingerite as a matrix for the pyrite. The hisingerite has a conchoidal fracture and a distinctly purplish cast on fresh surfaces. Examination of thin sections of the material show that the matrix is not entirely hisingerite but that it is filled with residual remnants of hypersthene as shown in Figure 2. The hisingerite is obviously an alteration product of the hypersthene. Several grains of hypersthene have the same orientation as shown by the cleavage in Figure 2. A more notable fact is that most of the hisingerite shown in Fig. 2 also extinguishes as a unit indicating a large crystal. Grains of quartz are scattered here and there in the hisingerite.

As far as known to the writer the derivation of hisingerite from hypersthene has not been previously described. Dana[5] suggests that it is derived from pyrite in some cases. This is possibly true to a small extent at Parry Sound as polished surfaces of the ores of some specimens show hisingerite projecting into pyrite. Figure 3 is a sketch of a polished surface of pyrite in a matrix of hisingerite. The pyrite fragments are remnants indicating an alteration to, or replacement of, pyrite by hisingerite. The mineral is also commonly found penetrating chalcopyrite along the parting planes which are developed in these specimens to an unusual degree.[6] This was noted both in thin section and on polished surfaces. Normally the hisingerite is a very narrow band along the parting but in some cases a considerable width is attained, as

[5] Dana, E. S., System of mineralogy, p. 702, 1911.

[6] Schwartz, G. M., *op. cit.*



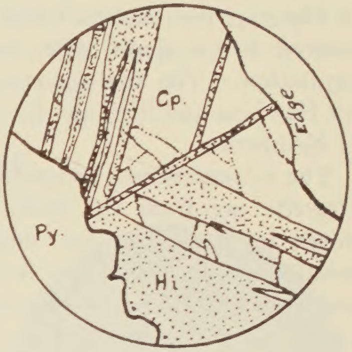


Fig. 3. (Left) Sketch of a polished surface showing residual grains of pyrite (Py) in hisingerite (Hi). Wilcox mine. Mag. × 35.

Fig. 4. (Right) Sketch of a polished surface showing chalcopyrite (Cp) penetrated and altered along parting to hisingerite (Hi). Specks of chalcopyrite are abundant in the hisingerite and the latter mineral cuts across chalcopyrite in veinlets. Wilcox Mine. Mag. × 18.

in Figure 4. These bands show abundant specks of chalcopyrite, and veinlets of hisingerite cross from one band of chalcopyrite to another. This suggests that the hisingerite has replaced the chalcopyrite and possibly the iron from the chalcopyrite entered the hisingerite.

In conclusion, it is believed that most of the hisingerite is derived from the alteration of hypersthene but it is possible that some of it represents an alteration of pyrite and chalcopyrite; but in any event hisingerite replaces these two minerals. As to the nature of the solutions which caused the alteration there may be some doubt. The writer expressed the opinion that the solutions which were responsible for the ores also altered the hypersthene, but more detailed work seems to render this improbable. The degree of oxidation of the iron and the manner in which the hisingerite occurs suggest alteration by meteoric waters. The fact that amorphous and crystalline forms occur together and that they are indistinguishable except with crossed nicols, indicates that this material is, in part, true crystalline hisingerite. Whether or not it is identical with canbyite, is not certain.

ASSAYING WITH THE BLOWPIPE; LEAD, COPPER AND SILVER ORES

WALTER F. HUNT, *University of Michigan*

Strictly speaking it cannot be said that the art of assaying with the blowpipe is a recent achievement. As early as 1827, while a student at Freiberg, Harkort conceived the idea of using the blowpipe for quantitative as well as for qualitative determinations and suggested a method for assaying silver ores. He had planned to work out methods for other metals but his early death prevented him from carrying on these investigations. His successor, Carl Friedrich Plattner, continued what Harkort had begun and extended the operations to include gold, lead, copper, bismuth, tin, nickel and cobalt.[1]

In all of these early attempts at quantitative work fusion was usually performed in a charcoal crucible which, by reason of its limited capacity and tendency to burn through, imposed certain hard and fast restrictions upon the assayer. The charge generally employed included only 100 mg. of the ore, which seems an unusually small amount for the successful operation of very lean ores. The time of fusion of necessity was short. Also the methods as outlined demanded considerable technique for the results obtained depended in no small measure upon the skill exercised by the operator in the manipulation of crucible and contents during the fusion period. To some or all of these objectionable features may be attributed the cause of the disuse of quantitative blowpipe methods in recent years. Finally, while results of a general quantitative character were no doubt obtained, no reference has been found where these determinations were checked against the results secured by other methods and their accuracy definitely established.

With the advent of the Fletcher Blowpipe furnace[2] a new impetus was given to blowpipe assaying. The size of the charge can easily be doubled and the effects of time of fusion or the influence of variation in flux can be more readily ascertained. Also, inasmuch as the general scheme employed is that of the

[1] Plattner's Blowpipe Analysis; translated by Henry B. Cornwall. Eighth edition, revised. D. Van Nostrand, *New York*. 1902.

[2] Quantitative Assaying with the Blowpipe, E. L. Fletcher. John Wiley & Sons. *New York*. 1906. This will be found an extremely helpful text for those wishing to become proficient in this work.

ordinary fire assay, no manipulation is necessary during the fusion period, thereby reducing the personal technique to a minimum and making it possible for the average careful student to obtain very satisfactory results.

In the following brief survey I desire to record the experience and results obtained by a number of students working independently when instructed to assay ores of lead, copper and silver. The entire equipment required is of such a character as to render it equally serviceable in the field or laboratory. In every instance the metal content of the ores had been previously determined either by wet methods, as in the case of lead and copper, or by the regular fire assay in the case of silver ores. The student, however, was not informed in advance as to the approximate metal content, and it was only after his report had been received that this information was given in order that he might note his error and possibly benefit thereby.

Assay of Lead Ores. In order to carry out the operation successfully certain general chemical considerations must be kept clearly in mind.[3] The fire assay for lead is always less accurate than the wet method. It can, however, be of practical service in the field and if the ores are of the simpler types, furnish a fairly close approximation of the true value. The three chief reasons for the inaccuracy of the dry method for the determination of lead are (1) lead and lead sulfide are both volatile at moderate temperatures; (2) there is a tendency for lead and its compounds to enter the slag which is increased by the presence of arsenic, antimony and zinc; (3) other metals such as copper and silver would also be reduced with the lead and form a common button. It would seem, therefore, that the best results might be expected if the heat be moderate, the time of fusion short, and the slag easily fusible but not too acid in character. The ores investigated included both sulfide (galena) and carbonate (cerussite) ores. Because of the low fusibility of galena the sulfur cannot be volatilized by roasting but can be removed by inserting a 7/8 in. "wire brad" in the crucible. The role played by the iron in the removal of sulfur can be readily understood from the following equations: $4\ K_2CO_3 + 7\ PbS = 4\ Pb + 3(K_2S.PbS) + K_2SO_4 + 4\ CO_2$. If iron were not present the double sulfide ($K_2S.PbS$) would enter the slag with resulting

[3] Notes on Assaying, Richard W. Lodge. Third edition, 1911, p. 190. John Wiley & Sons. *New York.*

loss of lead. By adding iron we have: $(K_2S.PbS)+Fe=(K_2S.FeS)+Pb$.

The charge, weighed in a portable pocket assay balance, which gave the best results contained:

ore	200 mg.
sodium carbonate	150
potassium carbonate	100
borax	20–50
flour	100
iron peg	
salt cover	

The time of fusion varied from 4 to 5 minutes. With the richer ores better results were obtained by placing the ore at the bottom of the crucible with the mixed flux on top. Should there be a tendency for the crucible to burn through a small amount of powdered silica should be added. If borax is used in too large amounts the slag becomes too acid and the loss of lead is thereby increased. The same charge can also be used for carbonate ores with the omission of the iron peg.

The actual recovery compared with the true values can be seen from the following table.

Galena ores		Cerussite ores	
% of Pb(wet)	% of Pb(dry)	% of Pb (wet)	% of Pb(dry)
86.5	77.5–80	42.8	40 –41.5
35.0	28.5–32	22.9	20.5–21.0
25.6	23 –24	14.4	11 –12

From the above it will be seen that the sulfide ores offer more difficulty than carbonate ores, although sulfide ores running as low as $7\frac{1}{2}$ to 8 % have been assayed. If the ore is very impure, containing a great deal of copper, antimony or arsenic, as would be the case of an intimate mixture of galena with tetrahedrite, no dry method could be recommended as the results would be unsatisfactory. But with the simpler types as indicated above fair approximations are possible.

Assay of Ores of Copper. As was the case in lead ores the dry assay of copper is not as accurate as any one of a number of wet methods. Still when the ores are of quite uniform grade and the character of the gangue known, satisfactory results can be obtained. These operations can also be adapted for field use where the facilities of a well stocked laboratory are absent. In

general the slag should be as nearly neutral as possible, the amount of flux small and the temperature high in order that the operation may be completed in as short a time as possible.[4] Sulfide ores should be roasted in a clay crucible which removes not only the sulfur but arsenic and antimony which might also be present. The time of fusion should be restricted to about 4 minutes. This is an important consideration especially with ores containing both copper and iron. An increase of a minute or two in the fusion period may add several percent of iron to the copper button. The reports here recorded cover a number of determinations made on chalcopyrite and malachite ores. When these ores are rather high grade the following general charge may serve as a convenient guide.

ore	200 mg. (previously roasted if sulfide)
sodium carbonate	100
potassium carbonate	100
borax	100
flour	125
flour cover	

In some instances minor changes must be made depending upon the character of the gangue. Very lean and siliceous ores require 150 mg. each of Na_2CO_3 and K_2CO_3. The copper should collect in a single button at bottom of crucible and can be weighed after a short refinement with boracic acid to remove traces of iron. In case of lean ores a slight modification is necessary as the small particles of copper remain disseminated throughout the slag. To overcome this difficulty 125 mg. of PbO should be added to the original charge. The copper is then collected by the reduced lead as it slowly settles to the bottom. When litharge is added to the charge the refining is somewhat extended, as it is now necessary to remove all this lead as well as traces of iron before the copper can be weighed. It is also very desirable to dissolve the copper button and test for iron and lead to prove their absence as the mere copper red color is not sufficient.

The following results record the amount of copper recovered and the percentages obtained by a wet method.

Chalcopyrite ores		Malachite ores	
% of Cu(wet)	% of Cu(dry)	% of Cu(wet)	% of Cu(dry)
22.5	20–21	30.7	29–30.5
11.0	10	12.2	9.5–11

[4] Notes on Assaying, Richard W. Lodge. Third edition, 1911, p. 213. John Wiley & Sons. *New York.*

In the above PbO was added only to those containing less than 10% Cu. It will be noted that the agreement between the "wet" and "dry" determinations are much closer in the case of copper than lead.

ASSAY OF SILVER ORES. Due to the greater value of silver and its more limited distribution in the rocks, compared with lead and copper, certain modifications in procedure are necessary and greater skill required if satisfactory results are to be obtained. If the student is permitted to precede his silver assays by those of lead and copper he will have acquired the necessary experience to successfully undertake this determination. The resultant silver bead is usually too small to weigh accurately on the portable balance which is used for weighing the flux. The weight can, however, be determined by measuring the diameter of the bead on an ivory scale devised by Plattner. The scale is based on the principle that the weights of metallic spheres are proportional to the cubes of their diameters, and that these diameters can be measured by means of two fine converging lines between which the spheres are placed. Transverse lines indicate directly the weights of silver beads tangent to the converging lines at the various points of the scale. Knowing the weight the percent of silver present can be calculated. As a one percent ore is equivalent to 291.66 troy oz., the oz. per ton of any ore can be easily computed.

The successive steps in the assaying of silver ores by the blowpipe furnace method may be indicated as follows: (1) roasting of sulfide ores to eliminate S, As, and Sb; (2) fusion for 6-7 minutes in a clay crucible; (3) refining with borax to remove impurities; (4) scorification in a clay capsule to oxidize the greater portion of the lead and last traces of copper; (5) cupellation on bone ash to remove the balance of the lead; and (6) measuring of bead and computation in oz. per ton.

It is extremely difficult to describe the end points of some of the above stages but this knowledge is easily acquired with a little experience. The most accurate portion of the ivory scale is confined to the middle third section. It is desirable, therefore, in assaying ores high in silver, to subdivide the rich-lead (lead and silver) button and scorify and cupel these portions separately in order to bring the bead within this section of the scale. On the other hand, very low grade silver ores should have the rich-leads of a number of assays united to obtain the best results.

As the charge varies somewhat with the character of the ore and its associated gangue, the one given below may be designated as the initial trial charge for silver ores in general.[5]

ore	200 mg.
sodium carbonate	200
potassium carbonate	100
borax	100
litharge	500
flour	100
salt cover	

For rich silver ores high in cobalt the ore might be advantageously reduced to 100 mg. and the borax increased to 200 mg.

In the concluding table will be found the results obtained by both the blowpipe and regular fire assay methods.

Regular Fire Assay	Blowpipe Assay
3470 oz. per T.	2900 –3500 oz. per T.
732.8	700 – 720
600	545 – 644
280	250 – 275
86	90 – 98
69	64 – 70
31.4	30 – 35
11	10 – 14

The variations in the figures listed in the right hand column represent the extreme values reported by different individuals. These ores might be considered typical, representing both lean and high grade types. Likewise, in some cases a great deal of impurity was encountered in the nature of copper, cobalt and nickel requiring repeated refining. In general it may be said that the average careful student, with some experience, should obtain results with silver ores easily within $\pm 10\%$ of the values obtained by the regular fire assay. While it is not claimed that these methods will ever replace the regular fire assay, still for fairly close approximations in field or laboratory these methods seem eminently satisfactory.

[5] To determine the amount of silver in argentiferous galena the charge to be recommended consists of: ore 600 mg., Na_2CO_3 300 mg., KNO_3 400 mg. and salt cover.

MARCASITE FROM THE RACINE DOLOMITE, RACINE, WIS.

CHAS. W. COOK, *University of Michigan*

The expedition to the northern peninsula of Michigan from the geological museum of the university in 1923 brought back a number of specimens of marcasite from the Racine dolomite. The material was found in the quarry of the Consumers Co., about three miles north of Racine, Wisconsin.

The crystals are described by G. M. Ehlers, by whom the specimens were collected, as occurring in cavities in the dolomite. The cavities range up to a foot or more in diameter and are irregularly distributed throughout the quarry.

The material shows a wide variety in the crystal development and the measurement of some of the crystals for the purpose of identification suggested that further examination of the material might be desirable. A survey of the literature showed that for such a common mineral a surprisingly small amount of work had been done on it. This is probably due not only to the fact that, being so common, the natural assumption would be that its possibilities for investigation had been exhausted, but also to the fact that its tendency to form twins, trillings, etc. is so great that it is somewhat difficult to obtain material which can be measured.

The material under discussion shows a wide variety in its habit; occurring as simple and complex crystals, and also in radiating globular, cockscomb, and spearlike masses. The individual crystals vary from very thin tabular crystals parallel to the basal pinacoid to thick stocky crystals. The tabular crystals generally show striations on the brachydomes parallel to the edge between the basal and brachypinacoids. The thick crystals, however, do not show the striations but a pronounced etching which gives them the appearance of having been built up of layers on the brachydome which have tended to cleave off. The material is all tarnished, the color varying decidedly in different specimens from a whitish yellow, through a lemon yellow to a dark brown. Some specimens show a tarnish so similar to that commonly observed on chalcopyrite that the presence of copper was suspected. Nevertheless tests failed to reveal its presence. The color of the untarnished material is tin white and not pale bronze yellow as stated by Dana.

Marcasite crystallizes in the orthorhombic system and the following forms were observed: pinacoids $c\{001\}$, $b\{010\}$; prism $m\{110\}$; macrodome $e\{101\}$; brachydomes $l\{011\}$, $z\{012\}$, $r\{014\}$, $w\{027\}$ (new), $x\{029\}$ (new); and pyramid $s\{111\}$. The previously reported forms not observed are: $a\{100\}$, $v\{013\}$, and $y\{025\}$. The two new forms $w\{027\}$ and $x\{029\}$ may be considered as definitely established since the agreement between the calculated and observed angles is very close.

	Observed	Calculated
$w : w' = (027) : (0\bar{2}7) =$	38° 46′	38° 51′
$c : x = (001) : (029) =$	15° 13′	15° 20′

The crystals show three definite habits of growth: (1) A thin tabular habit in which the predominating form is one of the brachydomes $r\{014\}$, $w\{027\}$, or $x\{029\}$. When this habit is assumed the other forms in the combination are the unit pyramid and the unit-, macro- and brachydomes, the two latter forms occurring as very thin edges. Less commonly the basal and brachypinacoids are present. (2) This habit is intermediate between (1) and (3) and is characterized by an almost equal development of the brachydomes $r\{014\}$ and $l\{011\}$. The unit prism and unit pyramid are practically always present. Occasionally the unit macrodome is present but no pinacoids were observed. (3) In this type of development the unit brachydome $l\{011\}$ is the predominating form. The crystals are always twinned so that no other form except the unit prism was definitely determined. The pyramids which are present have rounded faces so that it is impossible to measure them. This type of development also shows a strong tendency to parallel growth.

The goniometric measurements upon which the forms listed above are based are as follows:

	Observed*	Calculated
$m : m''' = (110) : (1\bar{1}0)$	74° 47′	74° 55′
$l : l' = (011) : (0\bar{1}1)$	101° 23′	101° 58′
$z : z' = (012) : (0\bar{1}2)$	63° 5′	63° 21′
$w : w' = (027) : (0\bar{2}7)$	38° 46′	38° 51′
$r : r' = (014) : (0\bar{1}4)$	34° 19′	34° 18′
$c : x = (001) : (029)$	15° 13′	15° 20′
$e : e' = (101) : (\bar{1}01)$	115° 35′	116° 20′
$s : s' = (111) : (\bar{1}11)$	66° 34′	66° 7′

* With the exception of the values for the new forms $w(027)$ and $x(029)$, the values are those given by Dana.

REPLACEMENT OF CALCITE BY GYPSUM

R. E. Rettger, *Cornell University*

The writer was recently presented with some specimens of Tertiary fossil shells, which are interesting because they appear to represent a complete replacement of calcite by gypsum.

The shells, whose structural features are well preserved, are mainly *Vasum*-like and *Clabalithes*-like forms. They were collected in Peru, South America, where they were found lying in the loose residual material derived from the weathering of a shale, and were distributed over a considerable area.

On superficial examination the specimens seemed to be normal calcareous shells; but closer study reveals occasional reflecting surfaces of gypsum crystals on the surface of the shell as well as in the cavities of the same. An acid test shows only slight and much localized effervescence, leading one to the conclusion that very little of the original carbonate of lime remains. The shells have retained practically their original shape and the surface irregularities are generally well preserved. Several of the specimens are unduly heavy due to the fact that the spiral cavities have been completely filled with gypsum.

Examination of thin sections of the shells under the microscope indicate quite clearly that gypsum has not only filled the shell cavities, but that the carbonate of lime of the shell itself has been almost completely replaced by that mineral. Some of the gypsum crystals in the cavities are quite large, several being noticed that were six millimeters in diameter. The structure of the spiral shell is well outlined by a dark substance which appears to be limonite and around which the gypsum has formed. Apparently the iron oxide was brought in and deposited around and in the calcite prior to its replacement by the gypsum.

Such a replacement as this can be explained by reactions which are common to the belt of weathering and would be expected to take place under certain favorable conditions.[*] It seems curious that such replacements are not more common in view of the widespread occurrence of calcite and the not uncommon presence of sulphuric acid as a product of sulphide alteration under surface conditions. So far as the writer is aware, however, there seems little or no reference in the literature to such a replacement process, and therefore this case seems worthy of record.

AN OCCURRENCE OF WITHERITE IN THE ALTYN LIMESTONE AT MANY GLACIER, MONTANA

Margaret Bradley Fuller, *Northwestern University*

During the field season of 1923 considerable witherite was observed filling cavities in the Altyn limestone of the Belt series in Glacier National Park. The chief exposures appear in the lower beds of the Altyn limestone immediately above the plane of the Lewis overthrust fault, along the gorge below Swiftcurrent Falls at Many Glacier. There are eighty to one hundred feet of the jointed platy limestone full of cavities containing the witherite.

The Altyn limestone in this locality is a highly siliceous calcium-magnesium-carbonate rock containing rounded to angular quartz and feldspar grains. The fresh surfaces are bluish-gray and very dense. The weathered surfaces are light buff to brown and dotted with etched grains of sand.

The witherite appears: (1) in flat masses one to six inches in thickness parallel to the bedding; (2) in thin lenses one to three inches thick and six to eighteen inches across; and (3) in very irregular lumps up to two feet in diameter. The mineral fills the cavities in pure translucent masses which are not associated with other minerals. The analysis shows 98.1% $BaCO_3$), 0.14% of SiO_2, and about one and a half percent of calcium and magnesium carbonates. The masses are colorless to pale buff and interlock in brush and fan shaped growths which extend from the walls of the openings towards the centers so as to nearly fill them. The contact with the limestone wall rock is very distinct. In many cases where the cavity fillings have been entirely removed the surface at the limestone contact is pitted with the impressions of the sand grains which lined the openings before the witherite was deposited. In no case were the sand grains observed included within the witherite. Evidently the openings were completed before the witherite began to fill them; replacement was not simultaneous with the solution of the wall rock.

BOOK REVIEWS

LEHRBUCH DER MINERALOGIE. B. Gossner, First Edition. Octavo. XII+404 pages, with 5 plates, including one of Agricola, and 465 text-figures. Fredrich Brandstetter, *Leipsig*, 1924.

In one sense this text is the successor of F. von Kobell's Mineralogie, which passed through seven editions, for it supersedes that well known work. In another

sense there is no relationship between it and the von Kobell textbook, except that the same firm published both books, for the present volume is entirely new.

The author has adopted an arrangement of the subject matter which is a marked departure from that ordinarily used during the past two decades, for geometrical crystallography and descriptive mineralogy receive but minor attention, speaking relatively. Furthermore, throughout the text an attempt is made to stress principles and processes and in this respect the treatment is somewhat similar to that used by Niggli in his recently published text (see review, *Am. Min.*, 1922, **7**, 125-126).

The book consists essentially of two parts:—I, General Mineralogy and II, System, formation, and occurrence of natural substances.

Part I is divided into three large subdivisions, (a) Physical Mineralogy, (b) Chemical Mineralogy, and (c) what may be designated as Geological Mineralogy. A new classification of minerals has been adopted in Part II, as follows: (a) Silicates, (b) Oxides and Hydroxides, (c) Sulphides, (d) Elements, and (e) Salt-like compounds of the common acids.

There is ample evidence that the text has been written by one eminently competent to make a broad minded and up-to-date survey of the subject. The text figures are well drawn and the plates excellent. However, it is to be sincerely regretted that better paper could not have been used. E. H. KRAUS.

MINÉRALOGIE DE MADAGASCAR. A. LACROIX. *Paris*. A. Challamel. Vol. III, vii+450 pages, 8 plates, 1 geological map in colors, and 28 figures. 1923.

The first two volumes of this work, published in 1922, were reviewed in the May, 1923 number of this journal. This, the last volume, continues part 4, devoted to LITHOLOGY, (pp. 1-90) and contains a discussion of the post-Lias volcanics and the sedimentary rocks. The alteration of the rocks to laterite and red earth is described in part 5 (pp. 91-149). Part 6 (pp. 150-294) treats of the mutual relationships of the rocks, and cites comparisons with similar rocks in other parts of the world. Appendices to all three volumes (pp. 295-334), a bibliography (pp. 335-350), and geographic and subject indices (pp. 351-431) conclude this volume.

E. F. H.

NEW MINERALS: DOUBTFUL SPECIES

CLASS: PHOSPHATES, ARSENATES, ETC.

"Kurskite"

VLADIMIR N. CHIRVINSKY: Materials for the knowledge of the natural productive forces of Russia. *Russian Academy Sciences*, **1919**. Also *Mineral. Abst.*, **2**, 53 (1923). Previously described but not named in *Neues Jahrb. Min.*, 61 (**1911**).

NAME: From the government of *Kursk*, Ukraine.

CHEMICAL PROPERTIES: A fluo- and carbonato-phosphate of calcium: $2Ca_3(PO_4)_2.CaCO_3.CaF_2$. Several partial analyses are given, one from Putiwl, Kursk, giving CaO 53.08, P_2O_5 32.49, CO_2 4.41, F 4.89.

PHYSICAL AND OPTICAL PROPERTIES: Structure, radial fibrous. Birefringence 0.008. Optically negative. Sp. Gr. 2.9.

OCCURRENCE: Widespread in the phosphorites of Russia and the Ukraine, as a cement, as a replacement of organic remains or as dark, almost black nodules.

DISCUSSION: The mineral differs in no essential respects from francolite, especially from the fibrous variety of francolite, the "staffelite." The analyses given, made upon impure material, differ but slightly from the analyses of francolite from other occurrences. W. F. FOSHAG.

"Meyersite"

CARL ELSCHNER: *Kolloid Zeit.*, **31**, 94 (1922).

NAME: In honor of H. H. *Meyers*, Industrial Fellow, Mellon Institute, University of Pittsburgh.

CHEMICAL PROPERTIES: A hydrous aluminum phosphate, $AlPO_4.2H_2O$. $AlPO_4$, 66.33%; $FePO_4$, 2.52%; H_2O, 26.10%.

PHYSICAL PROPERTIES: Apparently a colloid, perhaps metacolloidal, with agate-like bands.

OCCURRENCE: At Necker Island (near the Hawaiian Islands) in the cavities of a lava flow associated with guano and phosphatized coral limestone and apparently the result of the infiltration of phosphoric acid from the guano.

DISCUSSION: In general appearance and chemical composition this mineral is entirely similar to callainite. Both of these are apparently metacolloidal, and unless optical examination later shows it to be different, meyersite should be placed with that mineral. W. F. F.

CLASS: HYDROUS SILICATES

Chinkolobwite

ALFRED SCHOEP: Sur la Chinkolobwite, nouveau minéral uranifère du Katanga (On Chinkolobwite, a new uranium mineral from Katanga). *Bull. Soc. Belg. Geol. Pal. Hydrol.*, **33**, 87 (1923).

NAME: From the locality, *Chinkolobwe*, Belgian Congo.

CHEMICAL PROPERTIES: A hydrous silicate of uranium, suggested to be dimorphous with soddite. No analysis given.

CRYSTALLOGRAPHIC PROPERTIES: Rectangular, prismatic plates, system not stated.

PHYSICAL AND OPTICAL PROPERTIES: Color, canary yellow. Plane of the optic axis perpendicular to the elongation of the crystals. The plates are almost normal to the emergence of an optic axis. Elongation negative. Optical character negative. $\beta = 1.635$, $\gamma = 1.646$.

OCCURRENCE: Found as a felted mat of needles on a specimen of soddite.

DISCUSSION: The optical properties as far as are given indicate a new mineral but the data is too meager to class this as a well differentiated type. W. F. F.

PROCEEDINGS OF SOCIETIES

PHILADELPHIA MINERALOGICAL SOCIETY

Academy of Natural Sciences, April 10, 1924

A stated meeting of the Philadelphia Mineralogical Society was held on the above date with the vice-president, Mr. Trudell, in the chair. Twenty-one members and twenty-one visitors were present. Upon favorable recommendation of the council, the following were elected active members: Messrs. Thomas Stewart, Edmund Cienkowski, and George Faust. The following names were proposed for

active membership by Dr. Wills, Mr. Millson, and Mr. Cienkowski; Messrs. J. Carroll Moerk, Thomas J. Lewis, and Harold Rosen.

Mr. Horace Blank addressed the society on *The minerals of the rare earths.* The discovery of the rare earth elements and their difficulty of separation were described, introductory to an account of their chemical relationship and classification. The principal rare earth elements were then described, illustrated by many specimens, as well as a number of prepared salts. The absorption spectra of solutions of some of the salts were exhibited in a spectroscope. A rising vote of thanks was extended to the speaker for his interesting communication.

The following trips were described: Mineral Hill and Lima, Delaware County, by Mr. Biernbaum; Germantown quarries, by Mr. Knabe; Howellsville, by Dr. Wills; Wissahickon quarries, by Mr. Cienkowski; and Vanartsdalen's quarry, by Mr. Hoadley.

Mr. Cienkowski proposed that a series of prizes be offered to the boys of the Northeast High School for the best collections of minerals formed during the year. Mr. Biernbaum's special class in field mineralogy for the High School boys had proven so popular that it has been necessary to change the meeting place from Mr. Boyle's home to the High School. After a brief discussion, the chair suggested that if Mr. Cienkowski would draw up a plan, it would be approved by the society.

SAMUEL G. GORDON, *Secretary.*

NOTES AND NEWS

On May 26th Colonel Washington A. Roebling, Vice-president of the Mineralogical Society of America, celebrated his eighty-seventh anniversary. On this occasion a luncheon was served at his home for a few relatives and friends.

Industries Bulletin No. 101 of the South African Geological Survey gives full details regarding the recent discovery of platinum in South Africa. The bulletin was prepared by Percy A. Wagner and Tudor G. Trevor. The prevailing country rock is a felsite underlain by granite. There are numerous quartz-impregnated faults in the region and the main platinum lode occupies one of them. An abstract of this bulletin will be found on page 510 of *Science*, June 6, 1924.

Mr. Earl V. Shannon has recently described in the proceedings of the U. S. National Museum a new argentiferous sulphobismuthite of lead and copper. The mineral has been named *benjaminite*, in honor of Dr. Marcus Benjamin of the U. S. National Museum.

ABSTRACTS

THE POLYNARY MISCIBILITY OF GARNET MINERALS. W. EITEL. *Z. Krist.*, **56**, 526-31, (1921).

Of the garnets examined 15% were quaternary or quinary mixed xls., 60% ternary, and 17% binary mixtures. Elaborate 5-component diagrams showing the relationships are given.

PAUL BOONE.

STABILITY OF THE GLASS AND CRYSTAL PHASES OF SILICA. RUDOLF WIETZEL. *Z. anorg. allgem. Chem.*, **116**, 71-95, (1921); thru *Chem. Abstr.*, **16**, 3575, 1922.

The following systems were studied: quartz glass-cristobalite, quartz glass-quartz crystal, and cristobalite-quartz glass. There is a discussion of the relative solubilities of the various modifications of SiO_2.

E. F. H.

THE VAPOR PRESSURES OF THE OXIDES OF SILICON, ALUMINUM, CALCIUM, AND MAGNESIUM. OTTO RUFF AND PAUL SCHMIDT. *Z. anorg. allgem. Chem.*, **117,** 172-90, (1921); thru *Chem. Abstr.*, **16,** 190, (1922).

SiO_2 melts as α-cristobalite, at 1696±10°. Its boiling point is 2230°.

E. F. H.

THE BINARY SYSTEMS OF SULFATES, CHROMATES, MOLYBDATES AND WOLFRAMATES OF LEAD. F. M. JAEGER AND H. C. GERMS. *Z. anorg. allgem. Chem.*, **119,** 145-73, (1921); thru *Chem. Abstr.*, **16,** 1190, (1922).

Equilibrium diagrams are given for PbO-$PbSO_4$, -$PbCrO_4$, -$PbWO_4$, -$PbMoO_4$, and for most of the possible systems of the types $Pb(S,Cr)O_4$. $PbSO_4$ and $PbWO_4$ are dimorphous, with transition at 864° and 877°, respectively. Application of the results is made in the study of mineral composition. E. F. H.

X-RAY ANALYSIS OF THIRTEEN COMMON METALS. A. W. HULL. *Phys. Rev.* **17,** 571-88, (1921).

Powder analysis was the method used. Cr, Mo, and Ta are body-centered cubic, with sides respectively 2.895, 3.143, and 3.272 Å. Co_α, Ni, Rh, Pd, Ir and Pt are face-centered cubic, 3.554, 3.540, 3.820, 3.950, 3.805, and 3.930. Co_β, Zn, Cd, Ru are hexagonal close packed, of axial ratios 1.63, 1.86, 1.89, and 1.59; the sides of the triangular prisms are 2.514, 2.670, 2.960, and 2.686. In is face-centered tetragonal, side of prism 4.58, axial ratio 1.06. E. F. H.

THE FORMATION AND STABILITY OF MODIFICATIONS OF POLYMORPHOUS SUBSTANCES BELOW THEIR TRANSFORMATION TEMPERATURE. R. BRAUNS. *Centr. Mineral.* 225-9, (1921).

A number of examples (S, HgI_2, KNO_3, and others) are given of forms of polymorphous substances that exist below their inversion point. They obey the law of Ostwald, that the form obtained thru a spontaneous departure from a state (such as a solution) is that which involves the least loss in free energy. E. F. H.

REFRACTOMETER FOR THE DETERMINATION OF SOLID AND LIQUID SUBSTANCES. C. LEISS. *Z. Krist.*, **56,** 524-6, (1921).

This is a description with a figure of an instrument of the hemisphere type with several new appliances increasing its convenience and accuracy.

PAUL BOONE.

A REFRACTOMETER FOR THE DETERMINATION OF LIQUID MIXTURES. H. H. THOMAS AND A. F. HALLIMOND. *Mineralog. Mag.*, **19,** 124-129, (1921).

An apparatus designed to replace refractometers of the Pulfrich type for the determination of indices of immersion liquids. The new instrument depends upon the deviation of a ray of light incident on the oblique face between a prism of glass and the liquid to be determined. A direct vision spectroscope is used in which the liquid takes the place of the glass prism. To eliminate errors two rays are used, derived from two opposite inclined faces of a right-angled prism placed with the hypothenuse face perpendicular to the axis of the instrument. These rays form images on both sides of the eye piece-scale, the distance between the images recording the difference in index between prism and liquid in which the prism is immersed. Readings accurate to one unit in the third decimal place can easily be obtained. To cover the range of liquids from 1.47 to 1.74 it is desirable to have four prisms with indices 1.51; 1.58; 1.65; and 1.72, respectively. W. F. H.